

of a shell he had received from Mr. Barabino, a correspondent of his in New Orleans. He stated that his *Alasmodonta confragosa* was not found in the Mississippi River near New Orleans, but in Bayou Teche, Louisiana, "about two hundred miles N. N. W. from New Orleans." He also referred to the researches of another correspondent, Mr. O. Evans, which leave no doubt that *Ampullaria urceus*, published as a Mississippi River shell, is not an inhabitant of that stream; and made request for further information.

(To be continued)

---

## THE SEASONAL LIFE HISTORY OF A LAND SNAIL, *POLYGYRA THYROIDUS* (SAY)<sup>1</sup>

BY HARLEY J. VAN CLEAVE AND THURAL DALE FOSTER<sup>2</sup>

After many years of collecting and field study of *Polygyra thyroidus*, the wooded flood plain of the Sangamon River about one and one-half miles northeast of White Heath in Piatt County, Illinois, was selected as a site for intensive study of this species of land snail. From 1931 to 1936 the junior author of this paper took a series of thirty-two population samples from this area and made extended field and laboratory observations. The collections included at least two representative samples for every month of the year and for most months three or even four samples were available for study. More than 2700 individuals of *P. thyroidus* were studied. Periods of flood and other circumstances prevented sampling at regular monthly intervals. The analysis of these collections yielded many points of interest concerning the biology of *P. thyroidus*, considered in a manuscript thesis prepared by the junior author. Two sections of this thesis have been published previously (Foster, 1936 and 1937). The present paper includes observations and conclusions relating to the seasonal life history of *P. thyroidus*. Rate of growth was determined by distribution curves prepared for successive samples and checked by observations on individuals and groups kept in terraria.

---

<sup>1</sup> Contributions from the Zoological Laboratory of the University of Illinois.

<sup>2</sup> Mr. Foster died June 6, 1936.

In spite of prolonged observations, little information on mating in this species has been obtained. This is probably due to the fact that this species is largely nocturnal in habits and most of the field study was of necessity carried on in daylight. On November 2, 1931, a pair of these snails was found in copulation in the field just at twilight and on the evening of September 21, 1935, one pair was found in copula while a collection was being transported to the laboratory for study. These two instances give evidence that fertilization occurs in the fall. Collections of living snails brought into the laboratory in the fall have been kept under close observation for a period of five months, until eggs were laid, but the writers were not able to secure observations on copulation in these experiments.

In the laboratory, *P. thyroïdus* has been observed to deposit eggs as early as February 2, but in the field the earliest clutches of eggs were found on May 1 and other snails in the same area continued to deposit egg masses until August 15.

The eggs usually occur in small, shallow holes in excavations in the soil prepared by the snail. In the area studied, eggs have never been found in the debris or rotten wood. The masses encountered in the field contained 20 to 70 eggs each.

In terraria, at room temperature, 19 days has been the minimum time observed for hatching. However, eggs laid on the same day have shown as much as seven days' difference in incubation time when kept under the same general conditions of temperature and moisture. It is probable that there is even greater variability in incubation time under conditions of nature. The long egg-laying season, extending over several months, and the irregularity in time of hatching are factors which enable *P. thyroïdus* to maintain itself under the unstable conditions of the flood plain. Changes such as those produced by flood waters are usually of but short duration and could not wipe out an entire new generation as might be the case if all of the eggs were deposited at the same time.

There is extreme individual variation in growth rate in *P. thyroïdus*. In laboratory experiments it has been repeatedly noticed that young snails of this species hatched in a terrarium from the same clutch of eggs do not grow at a uniform rate even

when kept under similar environmental conditions. In a period of three months, individuals hatched at the same time and kept under identical conditions of light, moisture, temperature and food supply included some fully twice the shell diameter of others. Simpson (1901) noticed comparable differences in the growth rate of individuals of *P. albolabris*.

Individual variability in growth rate, the long period during which eggs are laid and highly variable seasonal and environmental conditions encountered by the young at the extremes of the reproductive season introduce a series of highly complex variables into the interpretation of population samples. As pointed out by one of the authors of this paper (Foster, 1936) the extremes in size of adult shells in this and other species of and snails are so conspicuously different that earlier writers attributed distinct varietal status to the extremes in shell size. Distribution of shell size in this species conforms to a normal distribution curve within which adult shells range from 18.5 to 24.5 mm. in greater diameter.

That growth rate is largely influenced by environmental conditions, as well as by individual peculiarities, has been shown by comparing rate of shell growth in specimens in terraria at room temperatures with individuals confined in enclosures out of doors. Previous observations based on analysis of successive samples had given evidence that *P. thyroïdus* makes little growth during the winter months. This species seems to be restricted to woods nettles (*Laportea canadense*) and possibly other succulent vegetation as food, for in nature there is little evidence of growth during the fall, winter and early spring. During the period from February 6 to April 3 forty-nine immature individuals of *P. thyroïdus* were placed in a screened outdoor enclosure in ground cover from their original habitat. In eight weeks these individuals added on the average but 0.09 mm. to the greater shell diameter. In the same period a comparable series kept in a terrarium at room temperatures and fed in lettuce showed an average increase of 1.3 mm. in greater diameter. On several occasions, young at room temperatures have shown an increase of more than 2 mm. in greater diameter per month and one individual grew 3 mm. in greater diameter in one month.

Upon hatching the young of *P. thyroidus* are approximately 3.5 mm. in greater diameter. Individuals of this size are found only with greatest difficulty in the loose soil and floor cover of the flood plain habitat.

Collections of immature individuals taken in the winter months have a mode of lesser diameters falling at 7.5 mm. Similar collections taken in spring months have a mode for lesser diameter of the shell at 8.5 mm. Woods nettles, the chief food plant of *P. thyroidus* begins to appear in late April or early May. Thereafter growth is rapid and by August the mode for immature shells is about 16.5 mm.

Practically all of the snails that pass one winter as immature young attain full growth, form a reflexed lip on the shell and are recognizable as mature adults by the following fall. Typically, the first breeding season is in the third year.

In the attainment of mature form individuals show marked differences. During summer and fall, when growth rate is most pronounced, the largest juvenile shells are as much as 4 mm. greater in diameter than the smallest adult shells living with them. Growth rate tends to be relatively slow in the first season after hatching. One millimeter increase in diameter is about normal during the four summer and early fall months following hatching. Small snails that enter the winter season with a diameter of only about 7.5 mm. show marked increase in growth rate when active feeding starts in late April or early May. For a short period in early spring the increase in diameter is at a rate of approximately 2.5 mm. per month.

Maturity requires more than one full year. The individuals which attain a lip in the fall of their second growing season produce eggs the following spring when they have just completed their second year or are entering on their third year. Three or possibly four years seems to be the usual length of life for individuals of this species.

#### REFERENCES CITED

- Foster, T. D. 1936.—Size of shell in land snails of the genus *Polygyra*, with particular reference to major and minor varieties. *Amer. Midl. Nat.*, 17 (6): 978-982.

————— (in press).—Productivity of a land snail, *Polygyra thyroides* (Say).

Simpson, G. B. 1901.—Anatomy and physiology of *Polygyra albolabris* and *Limax maximus* and embryology of *Limax maximus*. Bull. N. Y. St. Museum, Vol. 8, no. 40.

## A NEW *TURBONILLA* FROM MONTEREY BAY, CALIFORNIA

BY A. M. STRONG

In a reconnaissance survey of Monterey Bay, California, Dr. Tage Skogsberg of the Hopkins Marine Station of Stanford University has secured several specimens of an undescribed *Turbonilla*. These were submitted to Miss Myra Keen of the Stanford University Geology Department for identification; recognizing them as new she has in turn forwarded them to me for diagnosis and description.

Genus *TURBONILLA* Risso, 1826

Genotype by subsequent designation: *Turbonilla plicatula* Risso, 1826, not *T. plicatula* (Brocchi), 1814; (= *Turbonilla typica* Dall and Bartsch, 1903).

Subgenus *PYRGOLAMPROS* Sacco, 1892

Genotype: *Pyrgolampros mioperplicatulus* Sacco, 1892.

*TURBONILLA* (*PYRGOLAMPROS*) *SKOGSBERGI* Strong, new species.  
Pl. 4, figs. 3.

*Holotype*: Stanford Univ. Paleo. Type Coll. No. 6054. *Paratype*: Stanford Univ. Paleo. Type Coll. No. 6055. *Type locality*: Monterey Bay, five miles north of Monterey, California, at a depth of 28 fathoms.

*Description*: Shell slender, acutely conic, shining, whitish, with, beginning on the third or fourth whorl, a brown band covering the anterior third of the whorls between the sutures and extending over the periphery to the middle of the base; nuclear whorls small, depressed, not immersed, having their axis at right angles to that of the following whorls; postnuclear whorls moderately rounded, sutures distinct; axial sculpture consisting of about 18 broad, nearly straight, slightly protractive ribs which extend